dorsolateral brown band has a row of small dusky spots along its superior and inferior edges.

This species is near the *H. infratæniatus* Jan., and future investigation may prove it to be a variety of that species. In two specimens of the latter the scales are in seventeen rows, in three specimens of the *H. baliogaster* they are in nineteen rows. In a small *H. infratæniatus* the external edges of the dorsal band are not spotted but form a dark band. The color of the lower surface in the two species is quite different.

I note here that the *Helicops alleni* Garman, from Florida, has the scales entirely smooth. It is necessary therefore that it be placed in another genus, which I call Liodytes. Its diagnosis is that of Helicops with the addition, scales smooth.

ELAPS ALTIROSTRIS Cope. Three specimens.

BOTHROPS ALTERNATUS D. & B. Common.

Explanation of Plate.

Heads and tails of Amphisbænidæ. Fig. *a* Head, from above; *b*, from below; *c*, from the side; *d*, the tail with preanal plates and pores, from below.

Fig. 1. *Amphisbæna trachura* Cope.

Fig. 2. *Amphisbæna beniensis* Cope.

Fig. 3. *Amphisbæna occidentalis* Cope.

Fig. 4. *Amphisbæna angustifrons* Cope.

Fig. 5. *Aporarchus prunicolor* Cope.

Fig. 6. *Amphisbæna alba* Linn (Three specimens).

Fig. 7. *A. alba* var. *radiata* Cope. Caudal annuli 18; of the body 236; preanal plates 12; pores 8. Uniform white. Habitat unknown. One specimen.

Fig. 8. *A. alba* var. *dissecta* Cope. Annuli to vent 226; of tail 18; preanal plates 12; pores 8. Brownish above, below white. Venezuela. One specimen.

The Lineal Measures of the Semi-Civilized Nations of Mexico and Central America. By Daniel G. Brinton, M.D.

(*Read before the American Philosophical Society, January 2, 1885.*)

Positive progress in constructive art can be accurately estimated by the kind and perfection of the instruments of precision employed by the artists. A correct theory of architecture or of sculpture must have as its foundation a correct system of weights and measures, and recognized units and standards of gravity and extension. Where these are not found, all is guesswork, and a more or less hap-hazard rule-of-thumb.

In a study of the art-products of Mexico and Central America, it has occurred to me that we may with advantage call linguistics to our aid, and attempt to ascertain, by our analysis of the words for weights and measures, what units, if any, were employed by those who constructed the massive works in that region, which still remain for our astonishment. The tongues I shall examine are the Maya of Yucatan, its related dialect, the Cakchiquel of Guatemala, and the Nahuatl or Aztec of Mexico. The most striking monuments of art in North America are found in the territories where these were spoken at the time of the conquest. The Cakchiquel may be considered to include the Quiche and the Tzutuhil, both of which are closely associated to it as dialects of the same mother tongue.

The Mayas.

The generic word in Maya for both measuring and weighing, and for measures and weights, is at present *ppiz*, the radical sense of which is "to put in order," "to arrange in definite limits." Its apparent similarity to the Spanish *pesar*, French *peser*, etc., seems accidental, as it is in Maya the root of various words meaning battle, to fight, etc., from the "order of battle" observed on such occasions. Any weight or measure is spoken of as *ppizib*, to measure land is *ppiz luum*, a foot measure *ppiz-oc*, etc. But I am quite certain that the original scope of the word did not include weight, as there is no evidence that the ancient Mayas knew anything about a system of estimating quantity by gravity. If the word is not from the Spanish *pesar*, it has extended its meaning since the conquest.

The Maya measures are derived directly, and almost exclusively from the human body, and largely from the hand and foot.

Oc, the foot; *chekoc*, the footstep, the joint or length of the foot as a measure of length. Other forms of the same are *chekel*, *chekeb*, *chekeb-oc*, *chek-oc*, and this abundance of synonyms would seem to show that the measure of a foot was very familiar and frequent. The verb is *chekoc* (*tah*, *té*), as in the phrase:

Chekocté y-otoch Ku.
He measured by feet His-house God.

i. e. He measured by feet the church. From this was distinguished—

Xakab, paces or strides, a word confined to the paces of man. The verb is *xakab* (*tah*, *té*), to step off, to measure by paces.

Quite a series of measures were recognized from the ground (or, as some say, from the point of the foot) to the upper portions of the body.

Hun cal coy u-xul (one to the neck of the ankle its-end), extending from the ground to the narrowest portion of the ankle.

Hun ppuloc u-xul (one calf-of-the-leg its-end), from the ground to the highest portion of the calf of the leg. The word *xul* means end or limit, and is used often adverbially, as in the phrase *uay u-xul*, literally "here its end," or "thus far," (Span. *hasta aqui*).

Hun pixib, the distance from the ground (or point of the toes) to the knee-cap. From *piix*, the knee. Also called *hun hol piix*, from *hol*, head, the knee-cap being called "the knee-head."

Hun hachabex, one girdle, from the ground to the belt or girdle to which the skirt was fastened (from *hach*, to tie, to fasten). The same measure was called *hun theth*, the word *theth* being applied to the knot of the girdle.

Hun tanam, from the ground to the border of the true ribs, from *tanam*, the liver. The *Diccinario de Motul* gives the example, *hun tanam in ual*, one *tanam* (is) my corn, *i. e.*, my corn reaches to my chest. It adds that the measure is from the point of the foot to the chest.

Hun tzem, a measure from the ground to a line drawn from one mamma to the other.

Hun cal u-xul, one neck its-end, from the ground to the border (upper or lower?) of the neck.

Hun chi, from the mouth, *chi*, to the ground.

Hun holom, one head, from the top of the head to the ground. This is also called *hun uallah*, one time the stature or height of a man, from a root meaning "to draw to a point," "to finish off." The Spanish writers say that one *uallah* was equal to about three *varas*, and was used as a square measure in meting corn fields (*Dicc. Motul*). The Spanish *vara* differed as much as the English ell, and to the writer in question could not have represented quite two feet. Elsewhere he defines the *vara* as half a *braza* or fathom. (See below, *betan*.)

The hand in Maya is expressed by the word *kab*, which also means the arm, and is more correctly therefore translated

by the anatomical term "upper extremity." This is not an uncommon example in American tongues. When it is necessary to define the hand specifically the Mayas say *u cheel kab*, "the branch of the arm," and for the fingers *u nii kab*, "the points (literally, noses) of the arm" or upper extremity.

The shortest measurements known to them appear to have been finger-breadths, which are expressed by this phrase *u nii kab*. The thumb was called *u nā kab*, literally "the mother of the hand" or arm, and as a measure of length the distance from the first joint to the end of the nail was in use and designated by the same term.

With the hand open and the fingers extended, there were three different measures or spans recognized by the Mayas.

1. The *nāb*, from the tip of the thumb to the tip of the middle finger.

2. The *ɔeɔnab*, or little *nāb*, from the tip of the thumb to the tip of the index finger. This is the span yet most in use by the native inhabitants of Yucatan (Dr. Berendt).

3. The *chi nāb*, or the *nāb* which extends to the edge, from the tip of the thumb to the tip of the little finger (Pio Perez).

The *kok* was a hand measure formed by closing the fingers and extending the thumb. Measuring from the outer border of the hand to the end of the thumb, it would be about seven inches.

The *cuc* or *noch cuc* (*noch*, is a term applied to a bony prominence, in this instance to the olecranon) was the cubit, and was measured from the summit of the olecranon to the end of the fingers, about eighteen inches.

The most important of the longer measures was the *zap* or *zapal*. It was the distance between the extremities of the extended arms, and is usually put down at a fathom or six feet.

The half of it was called *betan* or *pātan*, meaning "to the middle of the chest." Canes and cords were cut of the fixed length of the *zap* and bore the name *zapalche*, *zap*-sticks, as our *yard-stick* (*che* = stick), and *hilppiz*, measuring rods (*hil*, a species of cane, and *ppiz*, to measure, *Dicc. Motul*).

On this as a unit, the customary land measure was based. It was the *kaan*, one shorter, *hun kaan tah ox zapalche*, a *kaan* of three *zap*, and one longer, *hun kaan tah can zapalche*, a *kaan* of four *zap*. The former is stated to be thirty-six fathoms

square, the latter forty-eight fathoms square. Twenty *kaan* made a *vinic*, man, that amount of land being considered the area requisite to support one family in maize.

The uncertainty about this measure is increased by the evident error of Bishop Landa, or more probably his copyist, in making the *vinic* equal to 400 square feet, which even in the most favored soils would never support a family. He probably said "400 feet square," which in that climate would be sufficient. The *kaan* is said by Spanish writers to be equal to the Mexican *mecate*, which contains 5184 square feet. I acknowledge, however, that I have not reconciled all the statements reported by authors about these land measures.

Greater measures of length are rarely mentioned. Journeys were measured by *lub*, which the Spaniards translated "leagues," but by derivation it means "resting places," and I have not ascertained that it had a fixed length.

The Mayas were given to the drawing of maps, and the towns had the boundaries of their common lands laid out in definite lines. I have manuscripts, some dating as early as 1542, which describe these town lands. In most of them only the courses are given, but not the distances. In one, a title to a domain in Acanceh, there are distances given, but in a measure quite unknown to me, *sicina*, preceded by the numeral and its termination indicating measures, *hulucppiz sicina*, eleven sicinas.*

The maps indicate relative position only, and were evidently not designed by a scale, or laid off in proportion to distance. The distinguished Yucatecan antiquary, the Rev. Don Crescencio Carrillo, in his essay on the cartography of the ancient Mayas,† apparently came to the same conclusion, as he does not mention any method of measurement.

I do not know of any measurements undertaken in Yucatan to ascertain the metrical standard employed by the ancient architects. It is true that Dr. Augustus LePlongeon asserts positively that they knew and used *the metric system*, and that the metre and its divisions are the only dimensions that can be applied

* Acanceh Cheltun. Titulo de un solar y Monte en Acanceh, 1767, MS.

† *Geografia Maya.* Anales del Museo Nacional de Mexico, Tomo ii, p. 435.

to the remains of the edifices.* But apart from the eccentricity of this statement, I do not see from Dr. LePlongeon's own measurements that the metre is in any sense a common divisor for them.

From the linguistic evidence, I incline to believe that the *oc*, the foot, was their chief lineal unit. This name was also applied to the seventh day of the series of twenty which made up the Maya month; and there may be some connection between these facts and the frequent recurrence of the number seven in the details of their edifices.†

The Cakchiquels.

The root-word for measuring length is, in Cakchiquel, *et.* Its primitive meaning is, a sign, a mark, a characteristic. From this root are derived the verbal *etah*, to measure length, to lay out a plan, to define limits; *etal*, a sign, mark, limit; *etabal*, measured field; *etamah*, to know, *i. e.*, to recognize the signs and characters of things; *etamanizah*, to cause to know, to teach, to instruct; etc.

My authorities do not furnish evidence that the Cakchiquels used the foot as a unit of measurement, differing in this from the Mayas. They had, however, like the latter, a series of measurements from the ground to certain points of the body, and they used a special terminal particle, *bem* (probably from *be*, to go), "up to" to indicate such measurements, as *vexibem*, up to the girdle (*vex*, girdle, *i*, connective, *bem*, up to, or "it goes to").

These body measures, as far as I have found them named, are as follows:

quequebem, from the ground to the knee.

ru-vach a, from the ground to the middle of the thigh; literally "its front, the thigh" (*ru*, its, *vach*, face, front, *a*, the muscles of the thigh).

vexibem, from the ground to the girdle, *vex*, which in ancient times supported the breech-cloth.

*"The metre is the *only measure of dimension* which agrees with that adopted by these most ancient artists and architects."—Dr. Le Plongeon, *Mayapan and Maya Inscriptions*, in Proceedings of the American Antiquarian Society, April, 1881.

†"Nearly all the monuments of Yucatan bear evidence that the Mayas had a predilection for the number *seven*," etc. Le Plongeon, *Vestiges of the Mayas*, p. 63, (New York, 1881). Of course, this may have other symbolic meanings also.

qualqaxibem, from the ground to the first true ribs.

kulim, from the ground to the neck (*kul*).

The more exact Cakchiquel measures were derived from the upper extremity. The smallest was the finger breadth, and was spoken of as one, two, three, four fingers, *hun ca*, *cay ca*, *ox ca*, *cah ca* (*ca* = finger). This was used in connection with the measure called *tuvic*, the same that I have described as the Maya *kok*, obtained by closing the hand and extending the thumb. They combined these in such expressions as *ca tuvic rugin hun ca*, two *tuvics* with (plus) one finger breadth (Coto, *Diccionario*, MS.).

The span of the Cakchiquels was solely that obtained by extending the thumb and fingers and including the space between the extremities of the thumb and *middle* finger. It was called *qutu*, from the radical *qut*, which means to show; to make manifest, and is hence akin in meaning to the root *et*, mentioned above.

The cubit, *chumay*, was measured from the point of the elbow to the extremities of the fingers. We are expressly informed by Father Coto that this was a customary building measure. "When they build their houses they use this cubit to measure the length of the logs. They also measure ropes in the same manner, and say, *Tin chumaih retaxic rigam*, I lay out in cubits the rope with which I am to measure." (*Diccionario*, MS.)

The different measures drawn from the arms were:

chumay, from the elbow to the end of the fingers of the same hand.

hahmehl, from the elbow to the ends of the fingers of the opposite hand, the arms being outstretched.

telen, from the point of the shoulder of one side to the ends of the fingers of the outstretched arm on the other side.

tzam telen, from the point of the shoulder to the ends of the fingers of the same side. *Tzam* means nose, point, beak, etc.

ru vach qux, from the middle of the breast to the end of the outstretched hand.

hah, from the tips of the fingers of one hand to those of the other, the arms outstretched.

Another measure was from the point of the shoulder to the wrist.

The *hah*, or fathom, was one of the units of land measure, and the corn fields and cacao plantations were surveyed and laid out with ropes, *gam*, marked off in fathoms. The fields are described as of five ropes, ten ropes, etc., but I have not found how many fathoms each rope contained.

Another unit of land measure in frequent use was the *makoh*. This was the circumference of the human figure. A man stood erect, his feet together, and both arms extended. The end of a rope was placed under his feet and its slack passed over one hand, then on top of his head, then over the other hand, and finally brought to touch the beginning. This gives somewhat less than three times the height. This singular unit is described by both Varea and Coto as in common use by the natives.

There were no accurate measures of long distances. As among the Mayas, journeys were counted by resting places, called in Cakchiquel *uxlanibal*, literally "breathing places," from *uxla*, the breath, itself a derivative of the radical *ux*, to exist, to be, to live, the breath being taken as the most evident sign of life.

There was orignally no word in Cakchiquel meaning "to weigh," as in a balance, and therefore they adopted the Spanish *peso*, as *tin pesoïh*, I weigh. Nor, although they constructed stone walls of considerable height, did they have any knowledge of the plumb line or plummet. The name they gave it even shows that they had no idea what its use was, as they called it "the piece of metal for fastening together," supposing it to be an aid in cementing the stone work, rather than in adjusting its lines (Coto, s. v. *Ploma de albañil*).

The Aztecs.

In turning to the Mexicans or Aztecs, some interesting problems present themselves. As far as I can judge by the Nahuatl language, measures drawn from the upper extremity were of secondary importance, and were not the bases of their metrical standards, and, as I shall show, this is borne out by a series of proofs from other directions.

The fingers, *mapilli*, appear to have been customary measures. They are mentioned in the early writers as one equal to an inch. The name *mapilli*, is a synthesis of *maitl*, hand, and *pilli*, child, offspring, addition, etc.

The span was called *miztetl* or *miztitl*, a word of obvious derivation, meaning "between the finger nails," from *iztetl*, finger nail. This span, however, was not like ours, from the extremity of the thumb to the extremity of the little finger, nor yet like that of the Cakchiquels, from the extremity of the thumb to that of the middle finger, but like that now in use among the Mayas (see above), from the extremity of the thumb to that of the index finger ("cuanto se mide con el pulgar y el indice." Molina, *Vocabulario*).

There were four measures from the point of the elbow; one to the wrist of the same arm, a second to the wrist of the opposite arm, a third to the ends of the fingers of the same arm, and the fourth to the ends of the fingers of the opposite arm, the arms always considered as extended at right angles to the body. The terms for these are given somewhat confusedly in my authorities, but I believe the following are correct:

1. From the elbow to the wrist of the same arm; *cemmatzotzopatzli*, "a little arm measure," from *ce*, a, one, *ma* from *maitl*, arm or hand, *tzotzoca*, small, inferior, *patzoa*, to make small, to diminish.

2. From the elbow to the wrist of the opposite arm, *cemmitl*, an arrow, a shaft, from *ce*, and *mitl*, arrow, this distance being the approved length of an arrow. We may compare the old English expression, a "cloth-yard shaft."

3. From the elbow to the ends of the fingers of the same arm, *cemmolicpitl*, one elbow, *ce*, one, *molicpitl* elbow. This is the cubit.

4. From the elbow to the ends of the fingers of the opposite arm.

The following were the arm measures:

cemacolli, from the tip of the shoulder to the end of the hand (*ce*, one, *maçoa*, to extend the arm).

cemmatl, from the tip of the fingers of one hand to those of the other. Although this word is apparently a synthesis of *ce*, one, *maitl*, arm, and means "one arm," it is uniformly rendered by the early writers *una braza*, a fathom.

cenyollotli, from the middle of the breast to the end of the fingers (*ce*, one, *yollotl*, breast).

It is known thut the Aztecs had a standard measure of length

which they employed in laying out grounds and constructing buildings. It was called the *octacatl*, but neither the derivation of this word, nor the exact length of the measure it represented has been positively ascertained. The first syllable, *oc*, it will be noticed, is the same as the Maya word for foot, and in Nahuatl *xocpalli* is "the sole of the foot." This was used as a measure by the decimal system, and there were in Nahuatl two separate and apparently original words to express a measure of ten foot lengths. One was:

matlaxocpallatamachiualoni, which formidable synthesis is analyzed as follows: *matla*, from *matlactli* ten, *xocpal*, from *xocpalli*, foot-soles, *tamachuia*, to measure (from *machiotl*, a sign, or mark, like the Cakchiquel *etal*), *l*, for *lo*, sign of the passive, *oni*, a verbal termination "equivalent to the Latin *bilis* or *dus*" (Carochi, *Arte de la Lengua Mexicana*, p. 123). Thus the word means that which is measurable by ten foot-lengths.

The second word was *matlacyxitlatamachiualoni*.

The composition of this is similar to the former, except that in the place of the perhaps foreign root *xoc*, foot, *yxitl*, foot, is used, which seems to have been the proper Nahuatl term.

As these words prove that the foot-length was one of the standards of the Aztecs, it remains to be seen whether they enlighten us as to the *octacatl*. I quote in connection an interesting passage by the native historian, Fernando de Alva Ixtlilxochitl in his *Historia Chichimeca*, published in Lord Kingsborough's great work on Mexico (Vol. ix, p. 242). Ixtlilxochitl is describing the vast communal dwelling built by the Tezcucan chieftain Nezahualcoyotl, capable of accomodating over two thousand persons. He writes: "These houses were in length from east to west four hundred and eleven and a half [native] measures, which reduced to our [Spanish] measures make twelve hundred and thirty-four and a half yards (*varas*), and in breadth from north to south three hundred and twenty-six measures, which are nine hundred and seventy-eight yards."

This passage has been analyzed by the learned antiquary Señor Orozco y Berra.* The native measure referred to by Ixtlilxochitl was that of Tezcuco, which was identical with that

*Orozco y Berra, *Historia Antigua y de la Conquista de Mexico*, Tomo i, pp. 557-8 (Mexico, 1880).

of Mexico. The yard was the *vara de Burgos*, which had been ordered to be adopted throughout the colony by an ordinance of the viceroy Antonio de Mendoza. This vara was in length 0.838 metre, and as according to the chronicler the native measure was just three times this ($411\frac{1}{2} \times 3 = 1234\frac{1}{2}$, and $326 \times 3 = 978$), it must have been 2.514 metre. This is equal in our measure to 9.842 feet, or, say, nine feet ten inches.

This would make the *octacatl* identical with those long-named ten-foot measures, which, as I have shown, were multiples of the length of the foot, as is proved by an analysis of their component words.

This result is as interesting as it is new, as it demonstrates that the metrical unit of ancient Mexico was the same as that of ancient Rome—the length of the foot-print.

Some testimony of another kind may be brought to illustrate this point.

In 1864, the Mexican government appointed a commission to survey the celebrated ruins of Teotihuacan, under the care of Don Ramon Almaraz. At the suggestion of Señor Orozco this able engineer ran a number of lines of construction to determine what had been the metrical standard of the builders. His decision was that it was "about" met. 0.8, or, say, $31\frac{1}{2}$ inches.* This is very close to an even third of the *octacatl*, and would thus be a common division of lengths laid off by it.

I may here turn aside from my immediate topic to compare these metrical standards with that of the Mound-Builders of the Ohio valley.

In the *American Antiquarian*, April, 1881, Prof. W. J. McGee applied Mr. Petrie's arithmetical system of "inductive metrology" to a large number of measurements of mounds and earth-works in Iowa, with the result of ascertaining a common standard of 25.716 inches.

In 1883, Col. Charles Whittlesey, of Cleveland, analyzed eighty-seven measurements of Ohio earth-works by the method of even divisors and concluded that thirty inches was about the

* *Memoria de los Trabajos ejecutados por la comision scientifica de Pachuca en el año de* 1864, p. 357, quoted by Orozco. Almaraz's words are not at all precise: "la unidad lineal, con pequeñas modificaciones, debió ser cosa de 0, m 8, ó cuatro palmos próximamente."

length, or was one of the multiples, of their metrical standard.*

Moreover, fifty-seven per cent of all the lines were divisible without remainder by ten feet. How much of this may have been owing to the tendency of hurried measurers to average on fives and tens, I cannot say, but leaving this out of the question, there is a probability that a ten foot-length rule was used by the "mound-builders" to lay out their works.

It may not be out of place to add a suggestion here as to the applicability of the methods of inductive metrology to American monuments. The proportions given above by Ixtlilxochitl, it will be noted, are strikingly irregular (411½, 326). Was this accident or design? Very likely the latter, based upon some superstitious or astrological motive. It is far from a solitary example. It recurs everywhere in the remarkable ruins of Mitla. "Careful attention," says Mr. Louis H. Aymé, "has been paid to make the whole asymmetrical. * * * This asymmetry of Mitla is not accidental, I am certain, but made designedly. M. Désiré Charnay tells me he has observed the same thing at Palenque." These examples should be a warning against placing implicit reliance on the mathematical procedures for obtaining the lineal standards of these forgotten nations.†

Whatever the lineal standard of the Aztecs may have been, we have ample evidence that it was widely recognized, very exact, and officially defined and protected. In the great market of Mexico, to which thousands flocked from the neighboring country (seventy thousand in a day, says Cortes, but we can cut this down one-half in allowance for the exaggeration of an enthusiast), there were regularly appointed government officers to examine the measures used by the merchants and compare them with the correct standard. Did they fall short, the measures were broken and the merchant severely punished as an enemy to the public weal.‡

* *The Metrical Standard of the Mound-Builders.* Reduced by the Method of Even Divisors. By Col. Chas. Whittlesey (Cleveland, 1883).

† *Notes on Mitla*, in *Proceedings of the American Antiquarian Society*, April, 1882, p. 97.

‡ See Herrera, *Decadas de Indias*, Dec. ii, Lib. vii, cap. xvi, and Dec. iii, Lib. iv, cap. xvii. "Castigaban mucho alque falseaba medidas, diciendo que era enemigo de todos i ladron publico," etc.

The road-measures of the Aztecs was by the stops of the carriers, as we have seen was also the case in Guatemala. In Nahuatl these were called *neceuilli*, resting places, or *netlatolli*, sitting places; and distances were reckoned numerically by these, as one, two, three, etc., resting places. Although this seems a vague and inaccurate method, usage had attached comparatively definite ideas of distance to these terms. Father Duran tells us that along the highways there were posts or stones erected with marks upon them showing how many of these stops there were to the next market-towns—a sort of mile-stones, in fact. As the competition between the various markets was very active, each set up its own posts, giving its distance, and adding a curse on all who did not attend, or were led away by the superior attractions of its rivals!*

So far as I have learned, the lineal measures above mentioned were those applied to estimate superficies. In some of the plans of fields, etc., handed down, the size is marked by the native numerals on one side of the plan, which are understood to indicate the square measure of the included tract. The word in Nahuatl meaning to survey or measure lands is *tlalpoa*, literally "to count land," from *tlalli* land, *poa* to count.

The Aztecs were entirely ignorant of balances, scales or weights. Cortes says distinctly that when he visited the great market of Mexico, Tenochtitlan, he saw all articles sold by number and measure, and nothing by weight.† The historian, Herrera confirms this from other authorities, and adds that when grass or hay was sold, it was estimated by the length of a cord which could be passed around the bundle.‡

The plumb-line must have been unknown to the Mexicans, also. They called it *temetztepilolli*, "the piece of lead which is hung

*Habian terminos señalados de cuantas leguas habian de acudir à los mercados," etc. Diego Duran, *Historia de la Nueva España*, Vol. ii, pp. 215, 216. Both the terms in the text are translated *legua* in Molina's Vocabulary, so that it is probable that the resting places were something near two and a half to three miles apart.

†"Todo lo venden por cuenta y medida, excepto que fasta agora no se ha visto vender cosa alguna por peso." *Cartas y Relaciones de Hernan Cortes*, p. 105. (Ed. Gayangos.)

‡"Tenian medida para todas las cosas; hasta la ierva, que era tanta, quanta se podia atar con una cuerda de una braza por un tomin." Herrera, *Decadas de Indias*, Dec. ii, Lib. vii, cap. xvi. In another passage where this historian speaks of weights (Dec. iii, Lib. iv, cap. xvii), it is one of his not infrequent slips of the pen.

from on high," from *temetztli*, lead, and *piloa*, to fasten something high up. Lead was not unknown to the Aztecs before the conquest. They collected it in the Provinces of Tlachco and Itzmiquilpan, but did not esteem it of much value, and their first knowledge of it as a plummet must have been when they saw it in the hands of the Spaniards. Hence their knowledge of the instrument itself could not have been earlier.

The conclusions to which the above facts tend are as follows:

1. In the Maya system of lineal measures, foot, hand, and body measures were nearly equally prominent, but the foot unit was the customary standard.

2. In the Cakchiquel system hand and body measures were almost exclusively used, and of these, those of the hand prevailed.

3. In the Aztec system, body measurements were unimportant, hand and arm measures held a secondary position, while the foot measure was adopted as the official and obligatory standard both in commerce and architecture.

4. The Aztec terms for their lineal standard being apparently of Maya origin, suggest that their standard was derived from that nation.

5. Neither of the three nations was acquainted with a system of estimation by weight, nor with the use of the plumb-line, nor with an accurate measure of long distances.

An Experiment in Weather Forecast. By Pliny Earle Chase, LL.D.

(*Read before the American Philosophical Society, Jan. 16, 1885.*)

The class of '88, in Haverford College, have studied Chase's Elements of Meteorology, with a special view to the formation of trained habits of observation. They have acquired such skill in local weather forecast* that they undertook, early in December, to predict the probable regions of fair and stormy weather for all parts of the United States, on Christmas and New Year's days. The predictions were forwarded to Washington and submitted, through the courtesy of Gen. W. B. Hazen, Chief Signal

*The verifications, after two months' study, ranged between 74 and 90.3 per cent, the general average being 81.5 per cent.